AMENDMENTS TO THE CLAIMS

Please amend the claims as follows:

1. (Currently Amended) A towable marine acoustic source apparatus for use in seismic survey campaigns, comprising:

(a) an array including at least a first cluster, said array being adapted to general a seismic signal adapted to locate a subsurface structure in an earth formation, said first cluster including at least two acoustic sources each having a longitudinal axis, said first cluster being defined by a spatial relationship wherein:

(i) said acoustic sources are disposed at a substantially common depth, and

(ii) each said longitudinal axis of said sources are substantially orthogonal to a pre-determined direction of towing; and

(b) at least one protective tube for substantially enclosing one of a portion of a supply line between the termination and said acoustic sources, a positioning device, a gun controller and a depth measurement device.

2. (Original) The apparatus of claim (1) wherein said longitudinal axes of said acoustic sources are one of (a) generally parallel to the water surface, and (b) generally perpendicular to the water surface.

3. (Original) The apparatus of claim (1) wherein said protective tube comprises:

(a) at least one coupling, said coupling having a neck portion matable with said acoustic source and a barrel portion adapted to enclose a portion of the supply line, and

(b) at least one flexible sleeve joined to said coupling.

4. (Original) The apparatus of claim (1) wherein said first cluster comprises at least two air guns.

5. (Original) The apparatus of claim (4) wherein said air guns each have a connection interface adapted for receiving one of gas, electrical power, and data; and further comprising a first set of air guns having said connection interfaces oriented in a first direction and a second set of air guns having said connection interfaces oriented in

a second direction, said first direction being different from said second direction.

6. (Original) The apparatus of claim (4) wherein said air guns each have a connection interface adapted for receiving one of gas, electrical power, said connection interfaces being oriented in substantially the same direction.

7. (Original) The apparatus of claim (4) wherein said air guns each have a connection interface adapted to receive one of gas, electrical power, and data signals from a supply line; and further comprising a connector for coupling said connection interface to the supply line; said connector having a bent end that mates with the supply line without causing substantial bending of the supply line.

8. (Original) The apparatus of claim (4) wherein said coupling has a first and second mating shell.

9. (Original) The apparatus of claim (4) wherein said air guns each include ports, and wherein said first cluster is further defined by said air gun ports being aligned in substantially along a first plane.

10. (Original) The apparatus of claim (9) further comprising a second cluster of at least two air guns, said second cluster air guns each having ports aligned substantially along a second plane that is substantially parallel to said first plane.

11. (Original) The apparatus of claim (4) wherein said air guns each have a pre-defined center, said air guns having a center-to-center spacing is no greater than about D_s, where D_s is calculated by the equation: $D_s = .62 \cdot V^{1/3}$ meters, where V is a volume of a largest operative acoustic source in cubic inches.

12. (Original) The apparatus of claim (4) wherein said air guns each have a pre-defined center, said air guns having a center-to-center spacing that is no less than $(D_c - (D_c)(50\%))$, where D_c is calculated by the equation: $D_c = 2\left(\frac{3}{4\pi}\frac{P}{P_o}V\right)^{1/3}$, where P is an acoustical

source absolute pressure, Po is an ambient absolute pressure, and V is a volume of said acoustical source in said cluster.

13. (Currently Amended) A towable marine acoustic source apparatus deployable from a service vessel having a tow line that includes a termination, the apparatus comprising:

(a) an array including at least a first cluster, said array being adapted to general a seismic signal adapted to locate a subsurface structure in an earth formation, said first cluster including at least two acoustic sources each having a longitudinal axis, said first cluster being defined by a spatial relationship wherein:

(i) said acoustic sources are disposed at a substantially common depth, and

(ii) each said longitudinal axis of said sources are substantially orthogonal to a pre-determined direction of towing; and

(b) a harness connecting the sources to the termination, said harness absorbing a substantial portion of the tension force induced during towing.

14. (Original) The apparatus of claim (13) wherein said harness comprises a collar associated with each source and a plurality of linking members, said linking member providing a mechanical connection between each collar.

15. (Original) The apparatus of claim (13) wherein said longitudinal axes of said acoustic sources are one of (a) generally parallel to the water surface, and (b) generally perpendicular to the water surface.

16. (Original) The apparatus of claim (13) wherein said cluster comprises at least two air guns.

17. (Original) The apparatus of claim (16) wherein said air guns each have a connection interface adapted for receiving one of gas, electrical power, and data; and further comprising a first set of air guns having said connection interfaces oriented in a first direction and a second set of air guns having said connection interfaces oriented in a second direction, said first direction being different from said second direction.

18. (Original) The apparatus of claim (16) wherein said air guns each have a connection interface adapted for receiving one of gas, electrical power, said connection interfaces being oriented in substantially the same direction.

19. (Original) The apparatus of claim (16) wherein said longitudinal axes of said acoustic sources are one of (a) generally parallel to the water surface, and (b) generally perpendicular to the water surface.

20. (Original) The apparatus of claim (16) wherein said air guns each include ports, and wherein said first cluster is further defined by said air gun ports being aligned in substantially along a first plane.

21. (Original) The apparatus of claim (20) further comprising a second cluster of at least two air guns, said second cluster air guns each having ports aligned substantially along a second plane that is substantially parallel to said first plane.

22. (Original) The apparatus of claim (16) wherein said air guns each have a pre-defined center, said air guns having a center-to-center spacing is no greater than about D_s, where D_s is calculated by the equation: $D_s = .62 \cdot V^{1/3}$ meters, where V is a volume of a largest operative acoustic source in cubic inches.

23. (Original) The apparatus of claim (16) wherein said air guns each have a pre-defined center, said air guns having a center-to-center spacing that is no less than $(D_c - (D_c)(50\%))$, where D_c is calculated by the equation: $D_c = 2\left(\frac{3}{4\pi}\frac{P}{P_o}V\right)^{1/3}$, where P is an acoustical source absolute pressure, Po is an ambient absolute pressure, and V is a volume of said acoustical source in said cluster.

24. (Currently Amended) A method of performing a marine seismic survey to locate subsurface hydrocarbons, comprising:

(a) towing a plurality of acoustic sources each having a longitudinal axis; and

(b) providing an array having at least a first cluster, said array being adapted to general a seismic signal adapted to locate a subsurface structure in an earth

formation, the first cluster being formed by:

(i) positioning the acoustic sources along a plane generally parallel with a water surface; and

(ii) aligning the longitudinal axis of each acoustic source substantially orthogonal to a pre-determined direction of towing; and

(c) enclosing in a tubular member one of a portion of a supply line between a termination and the sources, a positioning device, a gun controller and a depth measurement device.

25. (Original) The method of claim (24) further comprising aligning the longitudinal axes of the acoustic sources in one of (a) generally parallel to the water surface, and (b) generally perpendicular to the water surface.

26. (Original) The method of claim (24) wherein the acoustic sources include at least two air guns each having a longitudinal axis, and a connection interface adapted for receiving one of gas, electrical power, and data.

27. (Original) The method of claim (26) further comprising: orienting the connection interfaces of a first set of air guns in a first direction; and orienting the connection interfaces of a second set of air guns in a second direction different from the first direction.

28. (Original) The method of claim (26) further comprising orienting the connection interfaces of the air guns in substantially the same direction.

29. (Original) The method of claim (26) further comprising aligning the longitudinal axes of the acoustic sources in one of (a) generally parallel to the water surface, and (b) generally perpendicular to the water surface.

30. (Original) The method of claim (26) wherein the air guns each have a pre-defined center, the air guns having a center-to-center spacing is no greater than about D_s, where D_s is calculated by the equation: $D_s = .62 \cdot V^{1/3}$ meters, where V is a volume of a largest operative acoustic source in cubic inches.

31. (Original) The method of claim (26) wherein the air guns each have a pre-determined center and the air guns having a center-to-center spacing no less than (D_c – (D_c)(50%)), where D_c is calculated by the equation: $D_c = 2\left(\frac{3}{4\pi}\frac{P}{P_o}V\right)^{1/3}$, where P is an acoustical source absolute pressure, Po is an ambient absolute pressure, and V is a volume of the air gun in the cluster.

32. (Original) The method of claim (26) wherein the air guns each include ports, and further comprising aligning the air gun ports substantially along a first plane.

33. (Original) The method of claim (32) further comprising forming a second cluster of at least two air guns each having ports; positioning the second cluster adjacent the first cluster; and aligning the ports of the second cluster air guns along a second plane that is substantially parallel with the first plane.

34. (Currently Amended) A method of performing a marine seismic survey to locate subsurface hydrocarbons, comprising:

(a) towing a plurality of acoustic sources each having a longitudinal axis; and

(b) providing an array having at least a first cluster, said array being adapted to general a seismic signal adapted to locate a subsurface structure in an earth formation, the first cluster being formed by:

(i) positioning the acoustic sources along a plane generally parallel with a water surface; and

(ii) aligning the longitudinal axis of each acoustic source substantially orthogonal to a pre-determined direction of towing; and

(c) connecting the sources to a termination to form a connection that absorbs a substantial portion of the tension force induced during towing.

35. (Original) The method of claim (34) wherein said connecting step includes fastening a collar on each source, and linking each collar to the termination.

36. (Original) The method of claim (34) wherein the acoustic sources include at least two air guns each having a longitudinal axis, and a connection interface adapted for receiving one of gas, electrical power, and data.

37. (Original) The method of claim (36) further comprising aligning the longitudinal axes of the acoustic sources in one of (a) generally parallel to the water surface, and (b) generally perpendicular to the water surface.

38. (Original) The method of claim (36) further comprising orienting the connection interfaces of a first set of air guns in a first direction; and orienting the connection interfaces of a second set of air guns in a second direction different from the first direction.

39. (Original) The method of claim (36) further comprising orienting the connection interfaces of the air guns in substantially the same direction.

40. (Original) The method of claim (36) wherein the air guns each have a pre-defined center, the air guns having a center-to-center spacing is no greater than about D_s, where D_s is calculated by the equation: $D_s = .62 \cdot V^{1/3}$ meters, where V is a volume of a largest operative acoustic source in cubic inches.

41. (Original) The method of claim (36) wherein the air guns each have a pre-determined center and the air guns having a center-to-center spacing in a range that is no less than $(D_c - (D_c)(50\%))$, where D_c is calculated by the equation: $D_c = 2\left(\frac{3}{4\pi}\frac{P}{P_o}V\right)^{1/3}$, where P is an acoustical source absolute pressure, Po is an ambient absolute pressure, and V is a volume of the air gun in the cluster.

42. (Original) The method of claim (36) wherein the air guns each include ports, and further comprising aligning the air gun ports generally along a first plane.

43. (Original) The method of claim (42) further comprising forming a second cluster of at least two air guns each having ports; positioning the second adjacent the first cluster; and aligning the ports of the second cluster generally along a second plane that is substantially parallel with the same plane.

44. (Original) A marine acoustic source system for use in seismic survey campaigns, comprising:

(a) an acoustic array including at least one cluster, said array being adapted to general a seismic signal adapted to locate a subsurface structure in an earth formation, said cluster having at least two acoustic sources, said sources each having a longitudinal axis, said cluster being defined by a spatial relationship wherein:

(i) said acoustic sources are aligned in a plane generally parallel with the water surface; and

(ii) each said longitudinal axis of said sources are substantially orthogonal to a pre-determined direction of towing;

(b) a supply line operatively connected to said acoustic array, said supply line adapted to convey one of power and data to said acoustic array;

(c) a protective tube enclosing at least a portion of said supply line;

(d) a harness that connects to each of said acoustic sources;

(e) a termination matable with said supply line and said harness;

(f) a tow line connected to said termination for towing said array through water; and

(g) a service vessel to which said tow line is attached.

45. (Previously presented) A towable marine acoustic source apparatus, comprising:

an array including at least a first cluster, said first cluster including at least two acoustic sources each having a longitudinal axis, said first cluster being defined by a spatial relationship wherein:

(a) said acoustic sources are disposed at a substantially common depth,

(b) each said longitudinal axis of said sources are substantially orthogonal to a pre-determined direction of towing; and

(c) each said longitudinal axis of said sources are substantially orthogonal to a horizontal plane.

46. (Previously presented) The apparatus of claim (45) wherein said first cluster comprises at least two air guns.

47. (Previously presented) The apparatus of claim (46) wherein said air guns each have a connection interface adapted for receiving one of gas, electrical power, said connection

interfaces being oriented in substantially the same direction.

48. (Previously presented) The apparatus of claim (46) wherein said air guns each have a pre-defined center, said air guns having a center-to-center spacing is no greater than about D_s, where D_s is calculated by the equation: $D_s = .62 \cdot V^{1/3}$ meters, where V is a volume of a largest operative acoustic source in cubic inches.

49. (Previously presented) The apparatus of claim (46) wherein said air guns each have a pre-defined center, said air guns having a center-to-center spacing that is no less than $(D_c - (D_c)(50\%))$, where D_c is calculated by the equation: $D_c = 2\left(\frac{3}{4\pi}\frac{P}{P_o}V\right)^{1/3}$, where P is an acoustical source absolute pressure, Po is an ambient absolute pressure, and V is a volume of said acoustical source in said cluster.

50. (Previously presented) A method of performing a marine seismic survey, comprising:

(a) towing a plurality of acoustic sources each having a longitudinal axis; and

(b) providing an array having at least a first cluster, the first cluster being formed by:

(i) positioning the acoustic sources along a plane generally parallel with a water surface; and

(ii) aligning the longitudinal axis of each acoustic source substantially orthogonal to a pre-determined direction of towing; and

(iii) aligning the longitudinal axis of each acoustic source substantially orthogonal to the water surface.

51. (Previously presented) The method of claim (50) wherein the air guns each have a pre-defined center, the air guns having a center-to-center spacing is no greater than about D_s, where D_s is calculated by the equation: $D_s = .62 \cdot V^{1/3}$ meters, where V is a volume of a largest operative acoustic source in cubic inches.

52. (Previously presented The method of claim (50) further comprising:

defining a center for each air gun; and

maintaining a center-to-center spacing no less than $(D_c - (D_c)(50\%))$, where D_c is

calculated by the equation: $D_e = 2\left(\frac{3}{4\pi}\frac{P}{P_o}V\right)^{1/3}$, where P is an acoustical source absolute pressure, Po is an ambient absolute pressure, and V is a volume of the air gun in the cluster.

53. (Previously presented) The method of claim (50) further comprising forming a second cluster of at least two air guns each having ports; positioning the second cluster adjacent the first cluster; and aligning the ports of the second cluster air guns along a second plane that is substantially parallel with the first plane.

54. (Previously presented) A marine acoustic source system, comprising:

(a) an acoustic array including at least one cluster, said cluster having at least two acoustic sources, said sources each having a longitudinal axis, said cluster being defined by a spatial relationship wherein:

(i) said acoustic sources are aligned in a plane generally parallel with the water surface;

(ii) each said longitudinal axis of said sources are substantially orthogonal to a pre-determined direction of towing;

(iii) each said longitudinal axis of said sources are substantially orthogonal to the water surface;

(b) a supply line operatively connected to said acoustic array, said supply line adapted to convey one of power and data to said acoustic array;

(c) a termination matable with said supply line;

(d) a tow line connected to said termination for towing said array through water; and

(e) a service vessel to which said tow line is attached.